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ABSTRACT

It was reasoned that readers who have difficulty processing intersentence relationships to discover main ideas of paragraphs would be among those identified as weak comprehenders by a standardized test measure. To test the hypotheses related to this premise, 48 community college students designated as good and poor comprehenders on main idea items were tested on three levels of paragraph organization--high, middle, and low levels of structural explicitness. Two principles of manipulation were applied to the paragraphs: explicit statement of both the main idea and the level(s) of subordination; and ordering sentences to place the main idea in first position, grouping details together. The results suggested that college freshmen have difficulty perceiving the main ideas in materials presented to them. Both good and poor comprehenders had some difficulty with main idea items when reading the middle-level presentations of paragraphs. The effects of the structural manipulations of text were found statistically significant over all analyses suggesting that the extent to which relationships were made explicit within paragraphs affected comprehension of main ideas. The most interesting result in the study, however, was the lack of evidence supporting the predicted interaction between comprehension ability and level of structural explicitness. (RL)

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Effects of Paragraph Structural Explicitness on Main Idea Comprehension of College Level Students with Varying Abilities

Shaila Penelope Wood

The study was designed to examine the relationship and effects of two independent variables, comprehension ability and paragraph organization, on readers' performance with items assumed to test main idea comprehension. Wiener and Cromer (1967) postulated a difference model of reading difficulty: Difference readers have adequate intelligence, adequate language and vocabulary skills but fail to process materials in ways appropriate to a specific reading goal. In this study structural variations of paragraphs were used to model experimentally an hypothesized reading strategy and corresponding difficulty. Paragraphs were selected from instructional materials and reading tests and manipulated to construct three levels of structural explicitness. Evidence was sought of readers who have adequate vocabulary and language skills but who fail to process intersentence relationships appropriately to determine the main ideas of paragraphs. In addition, evidence was sought indicating that the extent to which such relationships are made explicit through paragraph structure affects readers' comprehension of main ideas.

The task of comprehending main ideas appears troublesome for many college level readers. Coomber (1975) reported that college freshmen had difficulty perceiving the main ideas in reading materials presented to them. Coomber's study made practical application of work by such researchers as Davis (1968, 1971) and Spearitt (1972) who tried to identify component skills of reading comprehension by factoring test scores. Despite their

differences both researchers have identified following the structure of a passage as one of several measurable and identifiable comprehension skills.

Current interest among researchers in reading and cognitive psychology has been focused less on identifying skills as factored from outcome scores and more on inferring reading processes from reading protocols and recall measures. Current literature is replete with systems for analyzing text and for examining a reader's representation of text in memory (Frase, 1969; Fredericksen, 1972; Grimes, 1972; Marshall & Glock, 1978; Meyer, 1975). But while such studies have contributed to our understanding of what readers learn from text, they do not explain the difficulties that some readers appear to be having with comprehension of main ideas. The focus of discourse analysts has been on methods of analyzing text and categorizing text characteristics. Such research has proven especially fruitful for explaining the complex interactions of semantic and structural features of text as they affect comprehension. Little research exists, however, in examining structural features of text apart from content and the interaction of structural features with reader characteristics.

Evidence in empirical research suggests the comprehension of main ideas may be a reading difficulty among higher level students. Theoretical literature suggests that comprehension of main ideas is linked to a reader's awareness and utilization of structural features of text. The importance of understanding these features and readers' processing or inability with them may be especially significant as researchers try to understand skills, cognitive strategies and difficulties of learners in a multi-media environment.

Theoretical Perspective

The question of structural features of text and readers' skills and strategies with reference to them becomes especially important in view of some current emphases in media research. Several lines of investigation have been directed toward identifying structural characteristics of a given medium and exploring the relationships of such features to comprehension and learning. Salomon (1972, 1978, 1979) has argued the case: "The class of media characteristics which is both generic to them and which may be of potentially great relevance to learning is the way in which media select, highlight, structure and present information" (1978, p. 4). Drawing on the cognitive theory constructs of Berlyne and Bruner (Berlyne, 1965; Bruner, 1964), Salomon reasoned that codes which serve for communication purposes may also serve for covert mediational activities, that such codes may be internalized, and that, once internalized, such codes can be detached from their original contexts and generalized and thus made available as structures for thought. He hypothesized that one learns to use covertly in his/her representational system certain organizational patterns which he/she encounters as part of a medium's language of communication. As applied to the prose medium, such arguments suggest research which examines whether readers recognize structural features of passages and use them such that these features perform their proper role.

Structural approach. Initially, it may appear as a case of begging the issue to attempt to isolate a structural variable in prose and examine its effects on comprehension. Analyses of such scholars as Goodman (1968), Chafe (1972) and Grimes (1972) ~~and~~ are persuasive argument for assuming the shared properties of structure and content. Research by Bower (1976)

suggests that semantic features carry the information in story comprehension. Koen, Becker and Young (1969) found a complex relation between semantic features and structural cues as they studied readers' perceptions of paragraph structure. When one considers the problem from a media perspective, however, identification and examination of structural variables become more significant. A content approach--one that examines the content components of a given passage or message alone or in conjunction with learner variables--is an approach pertinent to various forms of media but also confounded by the constraints and peculiarities of a given communication medium. A structural approach to media aims at identifying what these constraints and peculiarities are, the better to understand how content might be best represented in a given medium for specified purpose and how characteristics of learners interact with identified features of media. A structural approach to prose may identify codes peculiar to the medium and, by extension, whether students have and use such codes and related skills in their reading of prose discourse.

Paragraph structure. Considerable theoretical literature exists discussing structural features of text and their relationship to comprehension. Paragraph structure has been identified as a feature unique to prose discourse. Olson (1977) described the importance of structural features within text as they establish logical relationships. Contrasting features of oral and written language, Olson argued that the forms by which statements are ordered within a paragraph in an unambiguous way is a structural constraint of prose exposition.

By the conventions of prose discourse, expository paragraphs are assumed to have such aspects as unity and hierarchy. Reading theorists

Gibson & Levin, 1975; Smith, 1971; Thorndike, 1917) have described comprehension as a process of selecting and utilizing critical features and relations. To comprehend the main idea of a paragraph, a reader must recognize and select criterial features which demarcate the main idea and comprehend the selected relations fully for what they are with respect to other content components of the paragraph.

Paragraph comprehension. Researchers (Coomber, 1975; Williams & Stevens, 1972) have reported that the main idea of paragraphs is best inferred from topic sentences in paragraphs that have topic sentences. To grasp the hierarchical and unity aspects of the paragraph, it is necessary to locate and distinguish that part or sentence of the paragraph whose content encompasses other subordinate points. Caldwell (1975) postulated a model of processing involved in comprehending the main idea of a paragraph. Building on the work of Goodman (1970), she suggested that readers create hierarchical arrangements of ideas, structuring and restructuring the hierarchy as information is incorporated. Readers presumably begin with the first sentence of a paragraph and subconsciously ask themselves a series of questions. Is it the main idea? Is it a supporting detail of a main idea yet to be introduced or an irrelevant detail? Caldwell's model predicts that implicit main ideas will be more difficult for readers to grasp since they cannot be confirmed by an explicit statement in the text. Williams and Stevens (1972) also found that paragraphs in which topic sentences are not explicitly stated are more difficult for readers; in addition, they have suggested that position of an explicitly stated topic sentence is a significant cue to readers. First position appears to be the most readily accessible, followed by last position and then embedded or implicitly stated topic sentences.

Structural code. From the perspective of Salomon (1972), any reader who is asking a series of questions such as those modeled by Caldwell (1975) has internalized the structural code of prose exposition: the logical ordering of main point and supporting detail. The organizational code of printed discourse has become a scheme for cognitive activity. The basis on which one is able to accept or reject a first, second, or any other sentence as a statement of main idea presupposes a skill with hierarchical arrangements of ideas. Of interest here is whether or not college level students have such a skill or set of strategies and apply them to main idea tasks. Evidence such as that reported by Braddock (1974) suggests that many of the reading materials encountered by college readers do not have easily accessible structural features. Paragraphs, for example, lacking an explicitly stated topic sentence require application of the hierarchical code on the part of the reader if main ideas are to be understood. Coomber's study (1975) suggests difficulties among students with main idea comprehension as measured by outcome scores. Cromer's work (1970) applies the difference model of reading difficulty to a specified skill or strategy of comprehension.

Difference Model of Reading Difficulty

Cromer has conducted a series of studies, inferring reading processes by examining how readers with varying abilities respond to different structural conditions of text. Wiener and Cromer (1967) reviewed empirical literature in the area of reading difficulty and categorized evidence as suggesting four models of reading difficulty. The difference model, the last of the categories, implies a mismatch between the individual's mode of responding and the pattern assumed necessary for adequate reading. In his

1970 study, Cromer found evidence for a group of readers who could decode words but who, he inferred, failed to process material by appropriate phrase groupings. An important contribution of Cromer's work is his reasoning for logically inferring reading processes from performance outcomes and for experimentally modeling inferred reading strategies. In brief, the reasoning involves hypothesized or contrasting ways for combining or failing to combine components of prose text and the probable consequences of such strategies on measured outcomes.

Intersentence processing. The inferential question in this study was concerned with whether readers process or ignore intersentence relationships when asked to identify the main ideas of paragraphs. Experimental modeling of the question was as follows: Readers, who, for some reason, failed to process intersentence relationships as structured by the writer would have difficulty with the published presentation of paragraphs, as represented in relatively low scores on main idea items. These same readers would pick up the structural cues, thus identifying and structuring generality and supporting detail and correctly identifying main ideas, when cues were heavily emphasized to make the structure of the paragraph explicit. Conversely, their reading would not be overly disrupted, as reflected in comprehension scores, when the intersentence relationships as structured in published text were disturbed by scrambling the sentences.

Supplantation. The heavy cuing of a treatment for specified purposes is understood in aptitude-treatment interaction research as supplantation: a process that replaces or supplants a mental operation already in the learner's repertoire but which he would have to activate on his own (Salomon, 1972). Treatments which supplant or heavily cue a mental process

are likely to have an imitative effect, the learner internalizing and using as a generalized scheme the process he observes. Applying the principle of supplantation to a treatment or condition of text focused on clause and intersentence relations suggests using cues of language and position to supplant the process of meaningfully ordering clause and sentence units into the paragraph structural hierarchy. Presumably, readers skilled with the structural code of paragraphs could activate appropriate strategies for comprehension tasks without explicit structural cues. Evidence reported by Frase (1969), Gibson and Livin (1975) and Golinkoff (1976) supports the contention that skillful readers bring organizing strategies to reading tasks.

Hypotheses

It was reasoned that readers who have difficulty processing intersentence relationships to comprehend main ideas would be among those identified as weak comprehenders by a standardized test measure. An aptitude-treatment interaction paradigm was used for the study to test the effects of both treatment and comprehension ability and, especially, to examine the interactive effects of ability with level of structural explicitness. Main effects were predicted for both comprehension ability and the manipulated variable, structural explicitness of paragraphs. Interaction effects were predicted between comprehension ability and level of structural explicitness: readers designated Poor Comprehenders were expected to be more affected by the paragraph manipulations than those designated Good Comprehenders.

Method

In order to test the hypotheses, subjects categorized as either Good or Poor Comprehenders were tested using materials representing three levels of structural explicitness. To interpret experimental outcomes as being the result of the manipulated structural variable, paragraph organization, it was necessary to control as nearly as possible for the effects of content, vocabulary deficiency, and extraneous variables associated with how students work with reading materials in a voluntary testing situation. The method used for controlling the effect of vocabulary deficiency is discussed in a subsequent section of this report. To control for the effects of content, all subjects read the same paragraphs, as defined by content, and answered the same comprehension questions. To control for extraneous individual difference variables, a repeated measures design was used.

Design

A 2 x 3 factorial design with repeated measures on one factor (Winer, 1971) was employed. Each subject read all three levels of paragraph presentation. To examine the effects of ability and the possible interactions of ability with structure, subjects were blocked according to comprehension ability. Paragraphs were manipulated to represent three levels of structural explicitness: high, middle, and low.

Subjects

One hundred and four students enrolled in English Composition and Reading classes at a community college participated in testing to determine reading abilities. Of these, 73 were selected as having vocabulary skills

sufficient for the reading tasks involved. The range in percentile rank of these students on the comprehension subtest used as the reading ability measure was the 3rd to the 95th percentile, according to national norms for college freshmen. To block for ability as required by the design, upper and lower extreme groups were formed with 24 subjects in each group. Thus of those students for whom ability measures were available, 48 were selected for inclusion in hypothesis testing.

The Nelson-Denny Reading Test: Form B was used to assess the reading abilities of participating students. Two subscores, Vocabulary and Comprehension, were used for subject selection and categorization. In accord with the difference model, it was assumed that students who could not decode reading materials at word level would not be differentially affected by structural manipulations of text. Thus students scoring in the lowest quartile, as determined by national norms for college freshmen, were eliminated as subjects for the study.

The blocking of subjects for ability is a controversial issue in the areas of aptitude-treatment interaction and reading research, and procedures used in this study require clarification. Studies reviewed in the area of reading research generally blocked for ability along the entire ability distribution, using a two or three group division. Theorists of aptitude-treatment interaction research oppose blocking except where extreme groups are used (Cronbach & Snow, 1977). For this study blocks approximately high and low thirds of the ability distribution were used after adjustment of subject selection for vocabulary deficiency. The margin between groups was established on the basis of the standard error of measurement for the Nelson-Denny Comprehension subtest. Those students whose Comprehension scores were at or above one standard error from the

median of the national norms were designated Good Comprehenders; those whose Comprehension scores were at or below one standard error from the median were designated Poor Comprehenders. The 24 subjects identified as Good Comprehenders had a mean Comprehension raw score of 54.46, with a range from 48 to 64. The 24 subjects identified as Poor Comprehenders had a mean Comprehension raw score of 27.18, with a range from 12 to 34.

Materials

The materials, a series of 15 paragraphs, were taken from published reading tests and exercise manuals specifically designed for high school and college level students. Multiple-choice questions designed to test reading comprehension were available with the paragraphs and were used, generally, as they had appeared in the sources. Each experimental booklet read by subjects had 15 paragraphs followed by several multiple-choice questions: one main idea item (criterion) and one or two detail items for a total of 40 questions.

Each of the 15 paragraphs was presented in three different levels of structural explicitness: high (HE), middle (ME), and low (LE). Thus with 15 paragraphs and three levels of structure, 45 paragraphs were available. To control for the effects of order and sequence and of interaction of content with structure, multiple forms of the test booklet were compiled. From the 15 paragraphs used in the study, three sets of five paragraphs were formed to distribute differences of topic and difficulty. A balanced procedure was used to assign sets of paragraphs and levels to six forms of the test booklet. Then to control for order and sequence, paragraphs of different structural levels were randomly ordered within each form. In

the experiment, each subject read 15 paragraphs, five from each level. Homogeneity of test forms was assumed: data supporting the assumption together with reliability statistics for the separate test forms are reported in Table 2.

Paragraph selection. Paragraphs were selected based on comparability of topic and length. The focus of the study on the paragraph unit proved to be a major constraint in selection: many of the reading tests designed for higher level students use multiparagraph passages. Paragraphs exerpted from fiction were excluded. Four sources were used: The Davis Reading Test, Series 1 for High School and College Students (Davis & Davis, 1957); the Nelson-Denny Reading Test, Revised Edition (Brown, 1960); Getting the Main Idea, Special Skills Series L (Boning, 1977), and Getting the Main Point, A Skill at a Time Series 6 (Pauk, 1975).

Materials were assumed appropriate for college level students on the basis of publishers' criteria, but to ensure that the paragraphs were not overly difficult, at least as measured by vocabulary and sentence length, readability analyses were made. Estimates of readability using the Fry Readability Formula (Fry, 1968), together with the sources of the materials selected and the distribution code are shown in Table 1.

INSERT TABLE 1 ABOUT HERE

It should be noted that paragraph structure was not a factor in selection. The exploratory purposes of the study were better served by

having paragraphs representing a broad range of expository passages and instructional materials. During the course of the research, analyses made for manipulating the structural variable supplied information about the structural patterns of the selected paragraphs. Some of the paragraphs used were relatively simple from a structural perspective while others were more complex.

Paragraph manipulation. The paragraphs selected from published materials served as the middle (ME) level of structural explicitness. Two additional presentations were developed by the experimenter according to criteria drawn from the literature: a high (HE) explicitness level of paragraph structure and a low (LE) explicitness level.

Level of structural explicitness was operationally defined as the extent to which the main idea (understood to encompass such terms as main point, primary concern, major emphasis) of the paragraph is stated explicitly and positioned as the first sentence of the paragraph and the extent to which supporting details are clearly subordinated. For the purposes of the study, the main idea of the paragraph was accepted as a given: that identified in published reading tests and texts as the correct choice for a comprehension item bearing on main idea.

To construct the HE presentations, each paragraph was analyzed for structure and content. If a topic sentence clearly stating the main idea was included somewhere in the published version, that topic sentence was moved to first position. If the main idea was stated explicitly in the first sentence of the published paragraph but obscured by a generality or clause inversion, the sentence was split or the clause order was reversed to make the statement of the main idea more clear. If the published

paragraph did not have an explicitly stated topic sentence, one was constructed and placed in the first position.

In paragraphs with more than one level of subordination, the structure was similarly made explicit by positioning of detail and by addition of words identified as structural markers. Thus in a paragraph concerned with the threat which birds pose to airplanes, the HE presentation was constructed to identify immediately for the reader the problem and the solution discussed. The published (ME) presentation is shown below.

> In 1973 an eagle struck a small airplane near the Vancouver, British Columbia, airport. The plane crashed and three people died. During 1974, birds attacked planes in Canada 352 times and possibly as many as fifteen hundred times in the United States. The best solution to the problem so far was developed by Canadian officials and is being tested in Vancouver. A radio-controlled, oversized, fake falcon is sent aloft to frighten the other birds. The model, designed by Robert Randall, can fly up to eighty-five miles per hour and carries a one hour's supply of fuel. From a distance, it has fooled even human bird watchers. (Boning, 1977, p. 25)

In the ME presentation the first sentence of the paragraph is a detail. The second and third sentences are also details, from which the skilled reader would infer that a problem concerned with birds and airplanes is being discussed. Beginning with the fifth sentence, a group of details relating to a solution to the problem is presented. The main idea of the paragraph has been identified by Boning as: "A fake falcon may be the solution to preventing certain airplane crashes" (1977, p. 25).

For the HE presentation, a topic sentence was constructed which stated explicitly both the problem in question and the solution being discussed. The first sentence thus identified the full range of content

components for the paragraph. The second sentence was designed to cue the reader to a set of details specifying the problem. A subtopic sentence was constructed to signal and emphasize the second group of details, those specifying the solution. Sentences specifying details and the order of those details were retained.

To construct the LE presentation, sentence order was scrambled. It was reasoned that such manipulation would impair or distort that part of paragraph meaning carried by the intersentence relationships. No content words were changed, nor were structure words removed. Pronouns were converted to nouns where the reference of pronoun to noun was lost in the reordering of sentences.

In summary, two principles of manipulation were applied: 1) explicit statement of both the main idea and the level or levels of subordination; and 2) ordering of sentences to place the main idea statement in first position and to group together details. Neither vocabulary nor general sentence style was changed in either conversion. All content components of the published (ME) paragraphs were retained.

Paragraph assessment. To assess the paragraphs in terms of the manipulated structural variable, three judges were given the principles of manipulation as summarized above and asked to rank-order the paragraphs as representing HE, ME and LE presentations. In all assessments the LE paragraphs were readily recognized. The rankings of one judge for all presentations agreed with the paragraph categorizations of the experimenter. Two judges had difficulty distinguishing HE and ME presentations for two of the 15 paragraphs (VI and VIII).

Criterion. The comprehension items taken from sources were edited for consistency. Main idea items were checked against all three presentations to ensure that paragraph manipulations had not changed the meaning of the paragraph for the skilled reader. Although comprehension of details was not related to the primary hypotheses of the study, observation of students working with pilot materials confirmed the experimenter's judgment that detail items were needed to balance the difficulties many students appeared to be having with main idea items for the ME and LE presentations. Where possible, detail items were taken from the published sources; however, because sentence order had been manipulated in the paragraphs, it was necessary that information for any one item be supplied within the limits of one sentence. When necessary, detail items were constructed.

Procedures

Subjects were administered the treatment during class sessions. Six forms of the paragraph booklets were randomly distributed among students together with machine scorable answer sheets. Students were told briefly the purpose of the research and asked to read the paragraphs and answer the comprehension questions. In response to students' questions and in accord with teachers' expressed concerns, students were told that the study, although related to their course work, was independent of course requirements and that their scores would have no bearing on course grades. A time limit of 40 minutes was established based on sampling during a pilot study in which no time limits were applied.

Participation in the study was voluntary. Teachers agreed to use class time for treatment sessions administered by the experimenter and students could attend or not, as they chose. Obtaining of reading ability measures was more problematic, requiring in some cases that students attend special sessions. As noted above, 104 students were tested for reading ability, and 48 of these were designated subjects in the two ability blocks of the study. Because of the tie-in with class sessions, students additional to those identified as subjects read the treatment paragraphs. The scores of all students reading the paragraphs were used as data for test analysis. Tests were scored by Test Scoring and Evaluation Services, Syracuse University.

Results

The data for testing hypotheses with analysis of variance were the three scores of 48 subjects designated Good and Poor Comprehenders on main idea items for each of the three levels of paragraph organization. A test analysis was also computed based on the scores of 210 first-year college students who read the paragraphs and answered comprehension items, which supplied reliability data for the composite instrument and evidence supporting homogeneity of test forms. In addition, individual test scores and difficulty indices for separate items were analyzed to examine response patterns with different kinds of paragraphs.

Homogeneity of Test Forms

The combined test score means and standard deviations, together with reliability statistics by test form, are reported in Table 2. For

purposes of analysis of variance on main idea scores across levels of paragraph organization, homogeneity of test forms was assumed. As mentioned previously, differences among individual paragraphs in either conceptual, structural or stylistic difficulty were recognized; however, the purposes of the study were best served by using a variety of paragraphs. Recognized differences in either readability or structural level of the published (ME) presentations were distributed as paragraphs were divided into three sets of five. Sets by structural level were distributed throughout the test forms. The means and errors of measurement among the different forms of the test on treatment materials are comparable.

INSERT TABLE 2 ABOUT HERE

Findings on Hypotheses

The results of an analysis of variance on main idea scores as a function of comprehension ability and level of structural explicitness in repeated measures are presented in Table 3. Cell means and standard deviations correspond with those reported for Good and Poor Comprehenders in Table 4. Main effects were found for reading ability as defined by the comprehension subscore of the Nelson-Denny Reading Test ($p < .05$) and for level of structural explicitness ($p < .001$). Contrary to prediction, evidence of interactive effects between comprehension ability and level of structural explicitness was not found in the data.

INSERT TABLES 3 AND 4 ABOUT HERE

Secondary Analyses

Blocking for ability. Literature reviewed for the study raised questions about conventions used in blocking for ability. Aptitude-treatment interaction theorists recommend blocking with extreme groups only, specifically upper and lower fifths of the distribution. When interactions have been explored in research on reading, however, three-level blocking or two-level blocking at or near the median has been used. Because data from the entire distribution were available for analysis, subjects were blocked for ability at extreme fifths and in thirds to explore the effect on results of blocking at different points. Results of the analyses of variance are reported in Tables 5 and 6, respectively. When blocking at extreme fifths, no evidence was found for interaction of ability with level of structure. Evidence of the main effect for structure found in primary hypothesis testing was consistently supported.

INSERT TABLES 5 AND 6 ABOUT HERE

Course x level of structure. One additional source of variance was examined as having possible effect on student performance:

Approximately half of the subjects designated Poor Comprehenders were taking a reading course at the time of testing and had had instruction in paragraph organization. Poor Comprehenders were thus divided into two groups: those taking Reading and those not. The main effect for structure was again significant ($p < .05$). No effect for course was apparent in the data ($F = .075$), nor were effects found for interaction between course and level of paragraph structure.

Main idea versus detail items. One of the assumptions of the study was that comprehension of main ideas would be facilitated or disrupted by the structural manipulations of the paragraphs, whereas comprehension of details for which information was supplied within any given sentence unit would not. Examination of the means and standard deviations on main idea comprehension and details supports the assumption. The mean scores of 73 subjects for comprehension of details were nearly identical across the three levels of paragraph structure: means were 7.42 (LE), 7.45 (ME), and 7.41 (HE); standard deviations were 1.09 (LE), 1.27 (ME), and 1.31 (HE).

Test Item Analyses

The test analysis computed by Test Scoring and Evaluation Services, Syracuse University, provides information concerning individual criterion items. Statistics were computed on the basis of all students who read the paragraphs and answered questions. No adjustment for vocabulary was possible since reading ability scores were not available for half of these students. Despite this limitation, however, the data supply information about response patterns for specific paragraphs and related

items. The difficulty levels reported in Table 7 represent the proportion of students who answered the item correctly. The figures are thus the percentages of correct responses for the same main idea item across levels of structural variation on the same paragraph. Discrepancies between two proportions for the same level on any given paragraph may be the result of order and/or sequence effects.

INSERT TABLE 7 ABOUT HERE

It is apparent from the statistics reported in Table 7 that the structural effect for the separate paragraphs was not evenly distributed across levels of paragraph organization. With some paragraphs the differences between the proportions reported appear to be between the published (ME) presentation and the enhanced (HE); with others the differences are between the ME and LE presentations. Differences in structure among the published paragraphs were noted during analysis of the paragraphs for revision and writing of the HE presentation; and similarly, differences were noted by the judges who rank-ordered the paragraphs by level of structural explicitness and had difficulty distinguishing between ME and HE presentations for two of the paragraphs. While consideration of structural differences among the separate paragraphs was not a question in this study, the data in the difficulty indices suggest further evidence for the effect of level of structural explicitness on readers' comprehension of main ideas. Where difficulty levels for ME and HE presentations are similar,

paragraphs in the ME presentation have relatively explicit structural codes.

Discussion

Results of the study suggest limited support for Coomber's findings (1975) that college freshmen had difficulty perceiving the main ideas in materials presented to them. In this study, both Good and Poor Comprehenders had some difficulty with main idea items when reading the published presentation of paragraphs, as measured by mean scores on these items. The effects of the structural manipulations of text were found statistically significant over all analyses made on the data. Thus evidence was found indicating that the extent to which relationships are made explicit within the paragraph affects readers' comprehension of main ideas.

Absence of Interactive Effects

The most interesting result in the study, however, was the lack of evidence supporting the predicted interaction between comprehension ability and level of structural explicitness. Theorists have argued that differences between good and poor readers are often differences of kind of reading behavior, as well as of level of skill. Good readers presumably bring skills and strategies to comprehension tasks which are different from those of poor readers. Evidence in the results of this study suggests that Good and Poor Comprehenders performed in similar ways: the effects of the structural variable were spread evenly across the ability distribution. Good Comprehenders had more difficulty than predicted with scrambled and published paragraphs; Poor Comprehenders had less difficulty than predicted with the scrambled presentation.

Wiener and Cromer (1967) modeled the concept of differences among good and poor readers and postulated a difference model of reading difficulty. Difference readers have adequate language and vocabulary skills but fail to process materials in ways appropriate to a specific reading goal. Results in this study suggest that many of the subjects of the sample may be "difference readers" in the area of comprehension involved with understanding intersentence relationships. Such readers fail to note and use the cues of language and position to structure intersentence relationships of the paragraph as written but have some other strategy for comprehending main ideas which is sometimes adequate and sometimes not. The higher mean scores for main idea items with the high explicit presentation suggest that subjects noted and used position and language cues when they were heavily emphasized. Thus one may infer that subjects representative of the population used in the study are familiar with the prose hierarchy (main idea and supporting detail) as a structural pattern and use it as a reading strategy with certain conditions of text. Those conditions may well be represented in the extent to which the structural pattern is explicit and the cues obvious.

One may also infer from the results, however, that subjects used in the study have other strategies for identifying the main ideas of paragraphs. While the mean scores for both Good Comprehenders and Poor Comprehenders were lower with the scrambled presentation of the paragraphs, the mean score of Poor Comprehenders was not as low as predicted. Thus readers identified by standardized test scores as having difficulty with comprehension were able to identify main ideas in paragraphs where the intersentence relationships as structured by the writer were disturbed. In addition,

statistics from the test analyses suggest that with six paragraphs, scrambling had little if any effect. And finally, although interpretation of individual test scores is speculative, examination shows subjects from all ability levels whose performance on scrambled paragraphs was equal to or higher than in the published presentation. Assuming that the scrambling of sentences within a paragraph removes or distorts cues of position and language which are part of the convention of prose, one may infer from the data that reading processes with respect to comprehension of main ideas cannot be simply interpreted as the getting or failing to note the structural cues of intersentence relationships.

Implications

It is possible in interpretation to focus on the failure of both Good and Poor Comprehenders in the study to note and use structural cues and thus use the results as evidence of reading deficiency. Readers may have learned the structural codes of prose and may use them when they are obviously and simply stated. Students may have limited proficiency with these codes and difficulty with materials structured in subtle or complicated patterns. Equally plausible, however, is the implication suggested by the results that readers have and are using strategies other than the traditional hierarchical pattern to group and structure the content components of paragraphs. The main idea comprehension of subjects in the study representing both extremes on a comprehension ability distribution appears to have been only moderately impaired by the scrambling of text structure.

One strategy possibly being used is the reading by lexical clustering discussed by Ferry (1975). According to theory, a reader focuses on

semantic units of text and thus perceives the lexical connectedness of a passage. In coherent discourse, words and phrases are distributed as concept clusters (i.e., repeated words, referent pronouns, synonyms and related words). As related to paragraphs, a paragraph unit presumably deals with some subject. Words within the paragraph would be grouped into sets according to the subject of the paragraph. The set or cluster with the highest density would represent for the reader the subject of the paragraph. Ferry reasoned that structural cues of language establish for the reader the relations between sets. In one paragraph used in the study (XIII: cf. Table 7), both Good and Poor Comprehenders selected as answer a foil which corresponds with a reading by lexical density. The paragraph and its accompanying item may be somewhat unusual in that a reading based on lexical density results in an emphasis of meaning different from the logical structure of the paragraph; however, the preferred answer choice was clear in descriptive data. Subjects may have ignored the structural cues in the paragraph altogether.

Speculation from the response patterns of subjects with respect to one paragraph is not evidence for inferring any particular process on the part of readers, nor was the purpose of the study to examine alternative strategies used by readers to identify main ideas. Rather, an attempt was made to determine the effects of variable paragraph organization on comprehension of main ideas for students with different reading abilities. The inferences about strategies drawn from the experimental results of the study are general: that readers may have ways of comprehending main ideas which are different from the assumed means of structuring intersentence relationships.

The value of speculation is the stimulation and directions it suggests for research. The critical aspect of a strategy of lexical clustering for comprehending the meaning of paragraphs is that, while it ignores intersentence relationships, it emphasizes the ways associations are made in comprehending oral discourse. If speech and prose are separate conventions of language with separate conventions for ordering relationships, as argued by Olson (1977), then presumably the strategies best suited to comprehending either prose or oral conventions capitalize on features distinctive to each. Lexical clustering, stated simply, is a strategy of picking up the repetitions of words and synonyms. It is a strategy more closely aligned with the repetitions of the oral tradition. However extensive or limited their experience with prose structure, students today are highly sophisticated in their experiences with other forms of media. Lexical clustering as a strategy of reading ignores intersentence relationships important in prose, but it is a strategy highly effective with some forms of televised instruction. It is possible that students are finding and using strategies for assembling the content components of messages which cross forms of media.

If such is the case (and the above reasoning and thus the implications for instructional research are speculative), instruction in reading which directs students to find the logical relationships among sentences will have to compete with highly tuned and highly serviceable strategies which ignore them. Additionally, and perhaps more important, whatever the understanding gained within the areas of reading research to date, it may now become necessary to think of a reader, however proficient by the measures of standardized tests, as someone more or less proficient in

literate codes and moreor less proficient in the codes of other media and selecting and using codes for structuring components of information within and across media forms.

Further Research

The inference and implications discussed above are drawn from limited evidence, but speculation suggests that issues raised may be critical to our understanding of how students work with instructional materials. Further research is needed to test hypothesized strategies for one or another reading task which either utilize or ignore the structural codes of the prose medium.

The suggestion discussed above that students may be transferring structural codes used from one medium to another is highly speculative; however, research is needed which explores this issue both theoretically and empirically. At this point little is known about how students process information presented to them through various forms of media. Nor is there much information about structural characteristics inherent to one given medium as compared with another. Whereas in this study, a theoretical formulation of paragraph structure could be drawn from established work on prose analysis, theory about the structural characteristics of such visual media as film and television has yet to be developed. As for empirical research, the design and procedures of the present study which control for both content variables and individual differences suggest a sensitive means for examining structural effects in a given series of presentations and of a given medium. Research with visual media similar to the present study needs to be done to strengthen the theoretical bases of what the codes of visual media are before research on the transferring of structural codes across media can progress.

REFERENCES

Berlyne, D. E. Structure and direction in thinking. New York: John Wiley and Sons, Inc., 1965.

Boning, R. A. Getting the main idea. Specific Skill Series L. Baldwin, N. Y.: Barnell Loft, Ltd., 1977.

Bower, G. H. Comprehending and reading stories. Division III Presidential Address, American Psychological Association, Washington, D. C., September 1976.

Braddock, R. The frequency and placement of topic sentences in expository prose. Research in the Teaching of English, 1974, 8, 287-303.

Brown, J. I., Nelson, M. J. & Denny, J. I. Nelson-Denny reading test. Boston: Houghton Mifflin Co., 1960.

Bruner, J. S. The course of cognitive growth. American Psychologist, 1964, 19, 1-16.

Caldwell, P. Perceptual and cognitive processes in reading: Analysis of the construction of a main idea statement. Paper presented at the Twentieth Annual Convention of the International Reading Association, New York, May 1975.

Chafe, W. L. Discourse structure and human knowledge. In J. B. Carroll & R. O. Freedle (Eds.), Language comprehension and the acquisition of knowledge. Washington: V. H. Winston, 1972, 41-70.

Coomber, J. E. Perceiving the structure of written materials. Research in the Teaching of English, 1975, 9, 263-266.

Cromer, W. J. The Difference model: A new explanation for some reading difficulties. Journal of Educational Psychology, 1970, 61, 471-483.

Cronbach, L. J. & Snow, R. E. Aptitudes and instructional methods. New York: Irvington Publishers, 1977.

Davis, F. B. Psychometric research on comprehension in reading. Reading Research Quarterly, 1971-72, 7, 628-678.

Davis F. B. Research on comprehension in reading. Reading Research Quarterly, 1968, 3, 499-545.

Davis, F. B. & Davis, C. C. Davis reading test: Series 1. New York: Psychological Corporation, 1957.

Ferry, C. L. Discourse coherence and readability: A study of the effects of coherence marker density on reading comprehension. Doctoral dissertation, University of Oregon. Ann Arbor, Mich.: University Microfilms, 1975, No. 76-5163.

Frase, L. T. Paragraph organization of written materials: The influence of conceptual clustering upon the level and organization of recall. Journal of Educational Psychology, 1969, 60, 394-401.

Fredericksen, C. H. Effects of task-induced cognitive operations on comprehension and memory processes. In J. B. Carroll and R. O. Freedle (Eds.), Language comprehension and the acquisition of knowledge. Washington: V. H. Winston, 1972, 41-70.

Fry E. A readability formula that saves time. Journal of Reading, 1968, 11, 574-577.

Gibson, E. J. & Levin, H. The psychology of reading. Cambridge, Mass.: MIT Press, 1975.

Golinkoff, R. M. A comparison of reading comprehension processes in good and poor comprehenders. Reading Research Quarterly, 1975, 11, 625-657.

Goodman, K. Reading: A psycholinguistic guessing game. In H. Singer & R. Ruddell (Eds.), Theoretical models of the reading process. Newark, Dela.: International Reading Association, 1970.

Goodman, K. The psycholinguistic nature of the reading process. In K. Goodman (Ed.), The psycholinguistic nature of the reading process. Detroit: Wayne State University Press, 1968.

Grimes, J. E. The thread of discourse. Ithaca, N. Y.: Cornell University Press, 1972.

Koen, K., Becker, A., & Young, R. The psychological reality of the paragraph. Journal of Verbal Learning and Verbal Behavior, 1969, 8, 49-53.

Meyer, B. J. The organization of prose and its effects on recall. Doctoral dissertation, Cornell University. Ann Arbor, Mich.: University Microfilms, 1975, No. 74-26,291.

Marshall, N. & Glock, M. Comprehension of connected discourse: A study into the relationships between the structure of text and information recalled. Reading Research Quarterly, 1978-79, 8, 10-56.

Olshavsky, J. An exploratory analysis of the reading process. Doctoral dissertation, Indiana University. Ann Arbor, Mich.: University Microfilms, 1975. No. 76-6289.

Olson, D. R. From utterance to text: The bias of language in speech and writing. Harvard Educational Review, 1977, 47, 257-281.

Pauk, W. Getting the main point: A skill at a time. Series 6. Providence, R. I.: Jamestown Publishers, Inc., 1975.

Salomon, G. Can we affect cognitive skills through visual media? An hypothesis and initial findings. AV Communication Review, 1972, 20, 401-422.

Salomon, G. Interaction of media, cognition and learning. San Francisco: Jossey-Bass Publishers, 1979.

Salomon, G. The languages of media and the cultivation of mental skills. Paper presented at the Annual Convention of the American Educational Research Association, Toronto, Ontario, March 1978.

Smith, F. Understanding reading. New York: Holt, Rinehart & Winston, 1971.

Spearitt, D. Identification of subskills of reading comprehension by maximum likelihood factor analysis. Reading Research Quarterly, 1972-73, 8, 92-111.

Thorndike, E. L. Reading as reasoning: A study of mistakes in paragraph reading. Journal of Educational Psychology, 1917, 8, 323-332.

Wiener, M. & Cromer, W. Reading and reading difficulty: A conceptual analysis. Harvard Educational Review, 1967, 37, 620-643.

Williams, M. & Stevens, V. M. Understanding paragraph structure. Journal of Reading, 1972, 15, 513-516.

Winer, B. J. Statistical principles in experimental design. New York: McGraw-Hill Book Co., 1971.

Table 1

Paragraph and Item Sources, Estimates of Readability, and Distribution Code

Paragraph and Main Idea Item	Source	Estimate of Readability	Distribution Group
I	DRT	9	A
II	DRT	9	A
III	DRT	8	B
IV	DRT	9	C
V	NDRT	9	C
VI	GMI	9	A
VII	GMI	10	A
VIII	GMI	10	B
IX	GMI	11	A
X	GMI	college	B
XI	GMI	9	B
XII	GMI	11	C
XIII	GMP	12	B
XIV	GMP	college	C
XV	GMP	6	C

Distribution Code:
Form J: A(ME) B(HE) C(LE)
K: A(ME) B(LE) C(HE)
L: A(HE) B(LE) C(ME)
M: A(LE) B(HE) C(ME)
N: A(LE) B(ME) C(HE)
O: A(HE) B(ME) C(LE)

Note: Readability determined by the Fry Readability Formula Graph. Estimates recorded as approximate grade level.

Sources

DRT: Davis Reading Test, Series 1 (Davis & Davis, 1957).
NDRT: Nelson-Denny Reading Test (Brown et al., 1960).
GMI: Getting the Main Idea, Specific Skills Series L (Boning, 1977).
GMP: Getting the Main Point: A Skill at a Time Series 6 (Pauk, 1965).

Table 2

Combined Test Score Means and Standard Deviations and Reliability Statistics by Test Form

Form	n	Mean	Standard Deviation	KR-20	Standard Error of Measurement
J	33	30.909	6.793	.894	2.207
K	38	32.000	3.509	.645	2.090
L	32	31.031	4.727	.786	2.186
M	34	32.941	5.110	.839	2.051
N	38	31.790	5.100	.822	2.153
O	35	32.914	3.988	.720	2.110

Table 3

ANOVA: Comprehension Ability Blocked at Upper and Lower Thirds x Level of Structural Explicitness

Source of Variation	SS	df	MS	F
Comprehension Ability	5.063	1	5.063	5.906*
Subjects (nested)	39.430	46	.857	
Level of Structure	19.264	2	9.631	12.135**
Structure x Ability	1.042	2	.521	.656
Subjects x Structure	73.026	92	.794	

*$p < .025$.

**$p < .001$.

Table 4

Means and Standard Deviations for Main Idea Items
Across Levels of Paragraph Organization
Level of Structural Explicitness

Ability Block	n	Low (LE)		Middle (ME)		High (HE)	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
All Subjects	73	3.356	.963	3.932	.903	4.233	.858
Good Comprehenders	24	3.500	1.022	4.208	.884	4.583	.776
Poor Comprehenders	24	3.333	.917	3.833	.963	4.000	.834

Table 5

ANOVA: Comprehension Ability Blocked at Upper and Lower Fifths x Level of Structural Explicitness

Source of Variation	SS	df	MS	F
Comprehension Ability	2.400	1	2.400	2.104
Subjects (nested)	20.533	18	1.141	
Level of Structure	10.300	2	5.150	8.327*
Structure x Ability	2.100	2	1.050	1.698
Subjects x Structure	22.266	36	.619	

*$p < .005$.

Table 6

ANOVA: Comprehension Ability Blocked at Thirds x Level of Structural Explicitness

Source of Variation	SS	df	MS	F
Comprehension Ability	6.750	2	3.375	4.218*
Subjects (nested)	55.208	69	.800	
Level of Structure	29.194	2	14.597	17.736**
Structure x Ability	.371	4	.306	.371
Subjects x Structure	113.581	138	.823	

*$p < .025$.

**$p < .001$.

Table 7

Difficulty Indices* for Main Idea Comprehension
Across Levels of Paragraph Organization

Paragraph	Level of Explicitness		
	Low(LE) Form	Middle(ME) Form	High(HE) Form
I	N.95, M.82	K.95, J.94	O1.00, L.94
II	N.61, M.82	K.79, J.97	O .83, L.81
III	L.25, K.37	O.74, N.71	M .91, J.91
IV	O.83, J.85	L.69, M.94	N .92, K.92
V	O.89, J.79	L.78, M.91	N .97, K.97
VI	N.55, M.68	K.95, J.85	O .91, L.91
VII	N.55, M.41	K.58, J.58	O .89, L.91
VIII	L.63, K.66	O.71, N.79	M .74, J.79
IX	N.74, M.97	K.71, J.55	O .91, L.84
X	L.75, K.68	O.94, N.87	M .88, J.76
XI	L.81, K.71	O.63, N.87	M .79, J.85
XII	O.54, J.45	L.88, M.76	N .87, K.87
XIII	L.06, K.05	O.20, N.08	M .65, J.33
XIV	O.46, J.30	L.41, M.38	N .58, K.42
XV	O.69, J.57	L.75, M.83	N .74, K.82

*Difficulty Index: The proportion of students who answered the item correctly.